

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

SUBJECT: Discussing the Relevance of the Wetland
Science Team (WST) to the EPA Mission

FROM: Charles A. Rhodes Jr., Ecologist, OMA

TO: Jennifer Fulton, Acting Assoc. Director, Office of Monitoring and
Assessment

DATE: 6 March 2017

Ex. 5 - Deliberative Process, non-responsive

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- During a preliminary review of a permit proposal in Chesapeake, VA, WST brought to bear a range of questions highly relevant to the 404 (b) (1) Guidelines (see memo below). The crux of the analyses is based on the expertise within the WST (e.g., forested wetland ecology, wetland functional assessment) and the knowledge of past and present wetland assessment documents (e.g., Ainslie et al., 1999; Havens et al., 2012—both of which included active participation in their development by WST staff).

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029**

SUBJECT: Initial Review of Tri-Cities Delineations and
Commentary

FROM: Charles A. Rhodes Jr., Ecologist, OMA

TO: Jessica Martinsen, CWA Regulatory Team Leader; Carrie Traver, OEP

DATE: 10 March 2016

A Brief Review

A memo requesting a wetland delineation confirmation was sent to the Norfolk District, US Army Corps of Engineers for the Centerville Property (Roth Environmental, LLC (2014)). In the memo they describe the geographic limits of the property in question (hereinafter referred to as the *Site*) as well as discuss the overall ecology of the area.

The memo describes the local topography. The *Site* is approximately 12 feet above sea level at the western portion of the property and slopes toward the east to approximately 6 feet above sea level. Most of the *Site* is underlain by the poorly drained Acredale silt loam soil series with a band of the frequently flooded Nawney silt loam soil series along the eastern margin of the property.

Smith et al. (1995), note that mineral soil flats are most commonly found on interfluves (i.e., the area between adjacent streams flowing in the same direction) or large floodplain terraces (as is likely in this case) where the main source of water is precipitation. They receive virtually no groundwater discharge (which distinguishes them from depressions and slopes). Dominant hydrodynamics are primarily via vertical fluctuations. They generally lose water by evapotranspiration, saturation overland flow, and seepage to underlying groundwater. They are distinguished from flat upland areas by their poor vertical drainage, often due to spodic horizons and hardpans, and low lateral drainage, usually due to low hydraulic gradients.

Given the elevation gradient (-6 feet in elevation over a relatively short distance) noted above and the references to “terrace” as the predominant landform, one might expect a pre-development condition on *Site* as a series of terraces drained by a “braided” (i.e., interweaved strands) network of first order streams flowing in a downgradient direction (e.g., similar to second bottoms or terraces as described in Wharton et al., 1982). As such the *Site* wetlands were originally a hybrid of flats with headwaters flowing from them.

The term “flats” connotes a monotonous landscape with no relief whatsoever. In a study of 24 reference wetland flats Havens et al. (2012) determined the average gradient to be a low but measurable .19 percent (Havens et al., 2001). In the current instance the gradient originally exceeded that average.

As with many forested wetlands, the wetland soil surface is characterized by “pit and mound” (also termed hummocks and hollows) microtopography which is ecologically significant with regard to functions such as water quality improvement, water storage and faunal and floral diversity (e.g., Robertson et al., 1978; Titus, 1990). The fallen logs, stumps, pits and mounds increase the irregularity of the landscape surface; serve as movement corridors for small mammals, habitat for other animals and microsites for some herbs and seedlings (Bratton, 1976; Thompson, 1980). Wardrop et al. (1998) list a series of wetland functions (e.g., maintenance of characteristic hydrological, biogeochemical and plant/animal diversity functions) that include microtopography as a contributing component.

Overland flow begins as sheet flow, but irregularities in the ground surface soon split it into rills (i.e., miniature gullies formed by a single rainfall event). Eventually seepage in the bottom of

the depression, augmented by the water entering in rills, accumulates to erode a self-sustaining, permanent channel through which the water drains away—the origin of a stream (Pielou, 1998). In flats characterized by a diversity of low areas, rainfall events often raise the water elevation in these storage areas, thereby adding to the water already contained on the soil surface and in the soil column. During rainfall events one would expect the water in this network of “braided” storage areas and watercourses to transport water slowly in a down gradient direction.

In the case of the Tri-City wetlands, precipitation was originally the primary source of water that eventually concentrates, (with likely surface water derived from the stair step drainage from terrace to terrace) first forming wetland drainage networks and then stream courses that flow away from the *Site*. Another notable feature of wetland headwaters and flats is the seasonal and episodic nature of the hydrology. The degree and variability of the surface and subsurface hydrology (e.g., seasonally high water table; seasonal and/or short term presence and storage of surface water) are important determinants of the functions that these wetlands perform.

Although the National Wetland Inventory map supplied indicates that the *entire area* is palustrine forested wetlands, the delineation map and supporting data sheets supplied by Roth indicate that there are approximately 30 acres of uplands and 60 acres of nontidal forested wetlands on the property (see Tables 1-3 below).

The site contains numerous ditches, with the largest, most prominent ditch network toward the southern/eastern end of the property. These ditches extend off the property in both western and eastern directions.

Based on the most recent correspondence (MSA, 2015; Tri-City Properties, LLC 2016) the current project entails development of an area of 53.8 acres of which 47.1 acres are jurisdictional wetlands. The predominant cover types are a mix of late successional forested wetland.

The permit applicants have proffered the following as mitigation for impacts:

- Preservation in perpetuity of a 145 acre buffer which is purported to mitigate for 14.5 acres of wetland (10:1 mitigation ratio?) (*Note: No net gain of wetland area or function*).
- Reestablishment and/or creation of 65.2 acres of prior converted cropland (*Note: Change of use returns these areas to 404 CWA permit requirements*) and cut-over upland areas (*Note: establishment of appropriate hydrology may be problematic*).

Table 1: Summary: Wetland Delineation Parameters—Wetland Sites*				
Site DS-	Additional Landscape Commentary	Wetland Hydrology Criteria Including Primary/Secondary Indicators	Soils Data	Vegetation Data-- Dominant Species: Tree/Sapling/Shrub/Herb Strata
2	Depressional area	Sat. w/in 18” 1/1	4-12”+ 10YR4/1- 10YR5/4 Sandy Clay Loam	RM-LP/RM/ PP /GC- RF**
3	Depressional	No Sat.	4-14”+	LP-SG/RM- GA / PP / NF -

	area	1/3	10YR4/1- 10YR5/4 Clay Loam	<i>RF</i>
5	---	Sat. w/in 20" 1/2	3-12"+ 10YR4/2- 10YR5/4 Sandy Clay Loam	SG/BB-RM/ <i>PP</i> /GC- <i>NF-LF</i>
7	---	No Sat. >18" 1/3	2-12"+ 10YR4/1- 10YR5/4 Clay Loam	<i>CO (20%)</i> -SG-M/RM- BB/HB- <i>PP</i> / <i>Carex spp.</i> - Chasm.
8	---	No Sat. 1/3	3-12"+ 10YR5/1- 10YR5/4 Clay Loam	RM- <i>GA-SO (40%)</i> /AE- RM-BB/HB/GC
13	Depressional area	Sat. at 26" 1/2	3-12" 10YR4/1- 10YR5/4 Clay Loam	SG- <i>SO (40%)</i> /RM-BB- HB/HB/GC
14	Depressional area	No Sat. at >24" 1/3	3-12"+ 10YR4/1- 10YR5/4 Clay Loam	<i>CO (40%)</i> -SG- <i>WO (25%)</i> /RM-BB- HB/HB/GC- Chasm.
15	Depressional area	No Sat. 1/3	3-15"+ 10YR4/1- 10YR5/4 Clay Loam	<i>CO (60%)</i> -SG-RM/BB- RM/HB/Chasm.
18	---	Sat. at 26" 1/3	4-14"+ 10YR4/1- 10YR5/4 Clay Loam	<i>CO (25%)</i> -LP-RM/RM- BB/ <i>PP</i> -GA/GC
19	---	No Sat. at >20" 1/3	7-14"+ 10YR4/1- 10YR5/4 Clay Loam	TP- <i>CO (30%)</i> - <i>SO (25%)</i> /HB-SE/ <i>PP</i> / Chasm.
20	---	Sat. at 10" 2/2	3-12"+ 10YR4/2- 10YR5/4 Sandy Clay Loam	SG-RM/BB-RM/ <i>PP</i> /GC
23	---	No Sat. at >18" 1/2	0.5-12"+ 10YR4/1- 10YR5/4 Clay Loam	SG- <i>WO2 (20%)</i> /BB- HB/HB- <i>PP</i> /Chasm.- <i>GA-Cg</i>

* Note: All sites were located within soil polygons denoted as on Acredale Silt Loam—a poorly drained hydric soil. The landform denoted is "Terrace" for all locations.

** Note: Significant species in bold italics; characteristic wetland oaks in red bold italics.

Table 2: Summary: Wetland Delineation Parameters—Upland Sites*				
Site DS-	Additional Landscape Commentary	Wetland Hydrology Criteria Including Primary/Secondary Indicators	Soils Data	Vegetation Data-- Dominant Species: Tree/Sapling/Shrub/Herb Strata
1	Adjacent to roadside ditch	No Sat. at >20" 0/0	4-14"+ 10YR4/1- 10YR6/1 Sandy Clay Loam	LP-RM/RM-HB/ GA -BO-SH/GC-LP
4	---	No Sat. at >20" 0/0	4-14"+ 10YR4/2- 10YR5/4 Sandy Clay Loam	LP-SG-RM/RM/ PP -BO/---
6	---	No Sat. at >24" 0/0	3-14"+ 10YR4/2- 10YR5/4 Sandy Clay Loam	LP-TP/RM-BB/ PP /---
9	Hummock area	No Sat. 0/0	5-14" 10YR4/2- 10YR5/4 Clay Loam	CO (60%)-SO (20%)/HB-SH/PP/ GC
10	---	No Sat. at >24" 0/0	3-12"+ 10YR4/3- 10YR5/4 Clay Loam	CO (35%)-TP-SH/AB-HB-SG/HB-PP/ GC
11	Hummock area	No Sat. 0/0	5-14"+ 10YR5/2- 10YR5/4 Clay Loam	SH-SG/HB-AB/ PP -HB/---
12	Elevated area	No Sat. 0/0	4-12"+ 10YR5/1- 10YR5/4 Clay Loam	SG- CO (30%)-LP/SH-HB/HB/Chasm.
16	---	No Sat. at >20" 0/0	5-14"+ 10YR5/1- 10YR5/4 Clay Loam	LP- CO (20%)-WO (20%)/AB-HB/ HB/ GC-Mitch.
17	Sloping area	No Sat. at >20" 0/0	4-12"+ 10YR4/2- 10YR5/4 Clay Loam	LP-SG/BB-SH-BO/ PP /GC
21	Elevated area	No Sat. at >20" 0/0	5-14"+ 10YR4/2- 10YR5/4 Sandy Clay Loam	CO (60%)-TP/AB-RM-BB/HB-PP / GC
22	---	No Sat. at >20"	4-14"+	TP- SO (30%)-LP/HB-

		0/0	10YR4/2- 10YR5/4 Sandy Clay Loam	RM/HB/GC
<p>* Note: All sites were located within soil polygons denoted as on Acredale Silt Loam—a poorly drained hydric soil. The landform denoted is “Terrace” for all locations.</p> <p>** Note: Significant species in bold italics; wetland oaks in red bold italics.</p>				

Table 3: Selected Plant Species			
Abbrev.	Common Name	Species	Wetland Indicator
AB	American beech	<i>Fagus grandifolia</i>	FACU
AE	American elm	<i>Ulmus americana</i>	FAC
BB	Blue Beech/Musclewood	<i>Carpinus caroliniana</i>	FAC
BG	Black Gum	<i>Nyssa sylvatica</i>	FAC
BO	Blackjack oak	<i>Quercus marilandica</i>	UPL
Carex	Sedge species	<i>Carex spp.</i>	N/A
Cg	Sedge	<i>Carex glaucescens</i>	OBL
Chasm.	Longleaf woodoats	<i>Chasmanthium sessiliflorum</i>	FAC
CO	Cherrybark oak	<i>Quercus pagoda</i>	FACW
GA	Green ash	<i>Fraxinus pennsylvanica</i>	FACW
GC	Giant Cane	<i>Arundinaria gigantea</i>	FACW
HB	Hornbeam	<i>Ostrya virginiana</i>	FACU
LF	Lady fern	<i>Athyrium felix-femina</i>	FAC
LP	Loblolly Pine	<i>Pinus taeda</i>	FAC
Mitch.	Partridgeberry	<i>Mitchella repens</i>	FACU
NF	Netted chain fern	<i>Woodwardia areolata</i>	FACW
PP	Pawpaw	<i>Asimina triloba</i>	FAC
RF	Royal fern	<i>Osmunda regalis</i>	OBL
RM	Red maple	<i>Acer rubrum</i>	FAC
SE	Slippery elm	<i>Ulmus rubra</i>	FAC
SG	Sweetgum	<i>Liquidambar styraciflua</i>	FAC
SH	Shagbark hickory	<i>Carya ovata</i>	FACU
SO	Swamp chestnut oak	<i>Quercus michauxii</i>	FACW
TP	Tulip poplar	<i>Liriodendron tulipifera</i>	FACU
WO	Water oak	<i>Quercus nigra</i>	FAC
WO2	Willow oak	<i>Quercus phellos</i>	FACW
<p>Bold italics: Diagnostic wetland species or species of wildlife importance.</p> <p>Bold red italics: Characteristic wetland oaks.</p>			

A brief inspection of the wetland areas in question revealed that many of the variables relevant to the functional assessment of coastal plain hardwood flats (Havens et al., 2012) would score high and confirm the functions performed in such areas.

Characteristic Functions of Hardwood Flats on Mineral Soils (Havens et al., 2012):

- Maintain Characteristic Habitat
 - $FCI = V_{wd} + V_{food} + V_{natural} + V_{density}/4$

- Maintain Characteristic Plant Community
 - $FCI = VFQAI + V_{canopy} + V_{regen} + V_{invasives}/4$
- Maintain Characteristic Water Level Regime
 - $FCI = V_{natural} + V_{drain} + V_{fill}/3$
- Maintain Characteristic Carbon Cycling Processes
 - $FCI = V_{wd} + VFQAI + V_{herb} + \text{Water Regime FCI score}/4$

For example the relevant vegetation community functional capacity index (FCI) includes a sub-index score of 1.0 (highest possible) for canopy tree dominance (V_{canopy}) which requires a canopy composition of >50% hardwoods; <25% pine and >10% oaks). A review of Table 1 demonstrates that the majority (8 of 13) of the wetland sample sites (i.e., DS-7, 8, 13, 14, 15, 18, 19, 23) far exceed these criteria. Based on past experience this level of canopy dominance by wetland oaks [either via percent aerial cover or biomass as expressed by diameter at breast height (dbh)] far exceeds that of most “reference standard sites” (i.e., least disturbed sites). Another variable ($V_{density}$) (relevant for the habitat FCI) also scores highly.

One variable (V_{regen}) scored relatively low as there were relatively few oak saplings found. This may be a function of the currently closed canopy combined with the relative shade intolerance of the oak species present (Fowells, 1965). The forest is in all likelihood, in excess of 50 years old at which time future gap phase dynamics may have a greater role in the future as canopy trees senesce and die, thereby opening gaps for oak recruitment.

With regard to maintaining a characteristic water regime and carbon cycling, much is dependent on the hydrology regime as influenced by the constructed ditch network. Archetypal flats exhibit primarily vertical water movement via precipitation, evapotranspiration and groundwater movement. Given the landscape position the wetlands in question (i.e., formed on terraces) historically may have had low energy braided stream discharges in addition to vertical water movement. This seems logical given the 6-foot elevation change from west to east (along the direction of past flow paths). The braided network may have formed the foundation for the deepened and enlarged drainage network that currently exists. The question remains whether the existing drainage ditches primarily serve to drain adjacent areas, convey water from higher areas to the west, or some combination of both.

Applying a Regional Perspective with Regard to Downstream Receiving Waters

An aerial photo inspection of the Stumpy Lake watershed demonstrates that the contributing watershed has been largely converted to residential and commercial development over the time since the impoundment's creation on the North Landing River early in the 20th century. Except for wetlands within the Stumpy Lake Natural Area, a great extent of the remaining wetlands in the contributing watershed are located in and near the *Site*. Given this circumstance, the question arises as to whether or not the Stumpy Lake system is at, near, or beyond the carrying capacity of the ecological system. Moreover the hydrological continuum of Stumpy Lake-North Landing River/Gum Swamp-Currituck Sound-Albemarle Sound raises the issue beyond the permit question at hand.

Howarth et al. (2000) note that more than 60% of the coastal rivers and bays in every coastal state of the continental United States are moderately to severely degraded by nutrient pollution. This degradation is particularly severe in the Mid-Atlantic States, in the southeast, and in the Gulf of Mexico. In summarizing a recent report by the National Research Council (2000) they cite several conclusions:

- Nutrient over-enrichment of coastal ecosystems generally triggers ecological changes that decrease the biological diversity of bays and estuaries.
- The marked increase in nutrient pollution of coastal waters has been accompanied by an increase in harmful algal blooms, and in at least some cases, pollution has triggered these blooms.
- Research during the past decade confirms that N is the chief culprit in eutrophication and other impacts of nutrient over-enrichment in temperate coastal waters, while P is most problematic in eutrophication of freshwater lakes.
- Human conversion of atmospheric N into biologically useable forms, principally synthetic inorganic fertilizers, now matches the natural rate of biological N fixation for all the land surfaces of the Earth.
- Both agriculture and the burning of fossil fuels contribute significantly to nonpoint flows of N to coastal waters, either as direct runoff or airborne pollutants.

Swackhamer et al. (2004) identifies a wide array of natural and anthropogenic sources of atmospheric nitrogen compounds, a good number of which are a function of urban, rural and agricultural development. They note that atmospherically deposited nitrogen has increased tenfold, driven by trends in urbanization, industrial expansion, and agricultural intensification. They cite studies that indicate that atmospheric deposition accounts for 27% of “new” nitrogen entering the Chesapeake Bay. Atmospheric deposition of nitrogen has received the most attention because it is the most limiting nutrient in marine, estuarine, and a few freshwater systems. They note that nutrient over-enrichment has been blamed for a wide array of impacts on aquatic ecosystems, including changes in the function and composition of the algal community, changes in the food web, and declines in water quality and fisheries habitat. Increases in nitrogen and changes in nitrogen sources can influence competitive interactions and succession among algal groups, as well as dominance by certain undesirable groups such as red tide dinoflagellates and toxic cyanobacteria (formerly blue-green algae). Moreover if the wetlands are successfully converted to other land uses the current processing sink could conceivably be a source of pollution to downstream receiving waters (emphasis added).

A publication by Gilliam and Skaggs (1981) is illustrative as they noted that the latest period of increased development activity at the time (1973) in the pocosin region of North Carolina coincided with the large algal bloom problems in the Chowan River. They found that peak runoff rates occurred earlier (on occasion 24 hours earlier) and were three to four times higher from developed sites than from similar undeveloped sites. From a cumulative environmental impact standpoint such effects, translated downstream to estuarine waters, were identified as having potentially significant negative impacts to downstream estuarine communities including shrimp, shellfish, commercial and recreational fisheries (Copeland et al. 1983, 1984).

Preliminary Recommendations

Ex. 5 - Deliberative Process

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Ex. 5 - Deliberative Process, non-responsive

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